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DIVERSITY, ABUNDANCE, AND SEASONALITY OF ADULT AND LARVAL SYMPHYTA (HYMENOPTERA) IN THE GEORGE WASHINGTON NATIONAL FOREST, VIRGINIA, AND THE MONONGAHELA NATIONAL FOREST, WEST VIRGINIA

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Abstract.—Adult Symphyta richness and abundance were studied using data collected from 36 Malaise traps in the Monongahela National Forest, Pocahontas County, West Virginia, and in the George Washington National Forest, Augusta County, Virginia. A total of 8,884 adults representing 155 species in 49 genera and 8 families were collected. Diversity estimators suggest that approximately 81% of the actual species present on the two forests were sampled over five years (1995–1999). Fifty percent of all adults (4,481) were *Acordulecera dorsalis* Say (Pergidae). The next most abundant species were *Pristiphora banksi* Marlatt (Tenthredinidae) (12.8%), *Pachynematus corniger* (Norton) (Tenthredinidae) (4%), *Pracharactus rudis* (Norton) (Tenthredinidae) (3%), and *Taxonus pallipes* (Say) (Tenthredinidae) (2%). Larval symphytan richness and abundance were determined by foliage collections from *Quercus* spp., *Carya* spp., and *Acer* spp. Symphytan larvae from foliage numbered 11,621 specimens representing eight genera. Sixty-three percent of all larvae (7,373) were *Acordulecera* spp. The next most abundant genus was *Periclista* (2,328) which accounted for 20% of the total larvae. Differences in species richness and abundance of both adults and larvae occurred between forests and between years.

Key Words: Symphyta, richness, abundance, diversity, *Acordulecera dorsalis*

Symphyta are an important and abundant part of the insect fauna in hardwood forests. The adults are pollinators (Goulet 1996) and the larvae of at least two species have been responsible for heavy defoliation of oaks (Eidt and Nichols 1970, Matuzewski and Ward 1977, Hutchinson 1998). Much attention has been given to the conifer-feeding Symphyta; however, little is known about the richness or abundance of the Symphyta that feed on hardwoods and other Symphyta associated with forest ecosystems. Malaise traps commonly sample adult sawflies, but have seldom been used to assess sawfly community composition. Though Symphyta comprised the bulk of the Hymenoptera collected by Malaise traps in one New York survey (Matthews and Matthews 1970), the focus was not Symphyta, so the researchers gave no details about the species captured or their abundance. Similarly, a study comparing the ef-

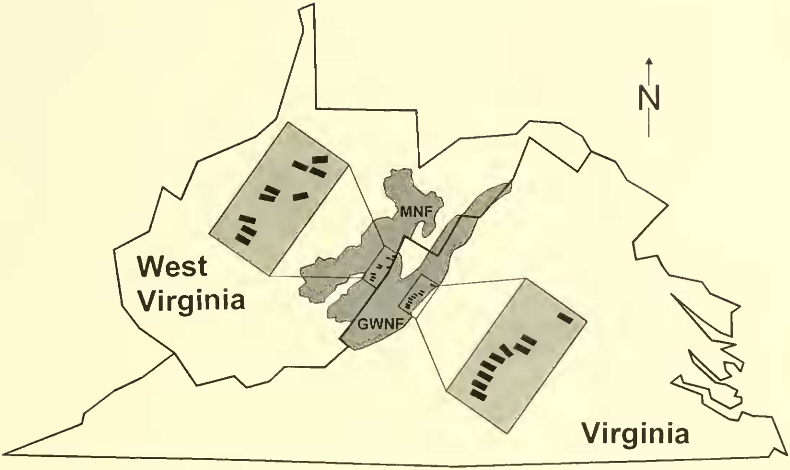


Fig. 1. Location of study plots in the George Washington National Forest and Monongahela National Forest.

fectiveness of different types of Malaise traps also mentioned Symphyta (Darling and Packer 1988), but they gave no information regarding richness or abundance in their predominantly oak setting. Other surveys have been conducted in urban environments (Smith and Barrows 1987) or have focused on a single genus (Smith 1991). The purposes of this study were to use Malaise traps for adults and foliage collections for larvae to determine which sawfly species are present in oak-dominated forests, measure their relative adult abundances, and document their adult seasonal occurrences.

Materials and Methods

This study was part of a long-term analysis of nontarget effects of *Bacillus thuringiensis* variety *kurstaki* and Gypchek™ when used to suppress *Lymantria dispar* (L.) (Lymantriidae). Eighteen 200-ha study plots were established in gypsy moth susceptible, oak-dominated forests. Plots one through nine were located in the Deerfield Ranger District of the George Washington National Forest (GWNF), Augusta County, Virginia (Fig. 1). The GWNF plots range in elevation from 586 to 791 m and are located in a xeric forest of mixed oak and pine. Plots 10 through 18 were located in both the southern Greenbrier Ranger District and the Marlinton Ranger District of the Monongahela National Forest (MNF), Pocahontas County, West Virginia (Fig. 1). The MNF plots range in elevation from 860 to 1,070 m and are more mesic than the GWNF plots (Butler and Strazanac 2000). These forests were selected for study in 1994 because they contained a high percentage of gypsy moth-preferred hosts and were located ahead of the leading edge of gypsy most movement. Each 200-ha plot contained a 30-ha subplot within which were two sites, one located on a ridge and the other in a valley or near a stream.

Sampling adult Symphyta was done using Townes-style Malaise traps (Townes 1962). Each trap was designated by both plot number and lower or upper site. Two Malaise traps were operated per plot, one on each site for a total of 36 traps for the study. Each trap was oriented on the plot so that its spine ran east-west. Each Malaise head contained a jar with 175 ml of 70% ethanol and was collected on the same day each week and replaced with a fresh jar of ethanol. Sampling was for 15 weeks from early May through mid-August for five years. In the laboratory, sawflies were separated from other insects. Specimens were mounted and identified by DRS.

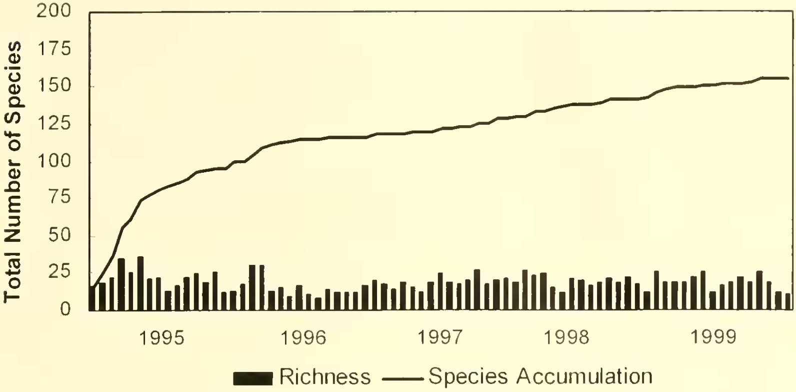
For larvae, five foliage samples per plot were taken each of 15 weeks from the lower and middle forest canopy using aluminum pruning poles with large plastic catch bags. Foliage samples were taken well within the boundaries of each plot, but just outside the bourdary of each subplot. One sample consisted of 21 branch-tip clippings from any species of maple (*Acer* spp.) except striped maple. The second sample consisted of 15 branch-tip clippings of any species of hickory (*Carya* spp.). The final three samples each consisted of 21 clippings of oak and contained either members of the red oak group [including scarlet oak (*Quercus coccinea* Muenchh.), black oak (*Q. velutina* Lam.), and red oak (*Q. rubra* L.)]; or the white oak group [chestnut oak (*Q. prinus* L.); or white oak (*Q. alba* L.)]. The foliage samples were taken to the laboratory and stored in a walk-in cooler until the arthropods could be removed from the foliage by hand during the following two days. All symphytan larvae were removed from the foliage and preserved in 70% alcohol for identification. Specimens were identified by DRS and RB.

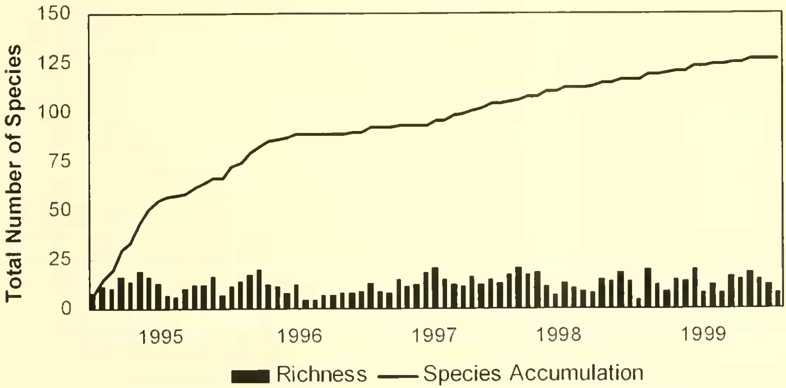
Voucher specimens of adults and larvae are deposited in the National Museum of Natural History, Smithsonian Institution, Washington, DC, and the West Virginia University Arthropod Collection, Morgantown, WV.

Results

Malaise samples provided a wealth of information about adult symphytan richness, abundance, and seasonal occurrence in a hardwood forest. Data were analyzed using the EstimateS 5 program (Colwell 1997). Diversity estimators produced a fairly narrow range of species estimates for both forests combined and each forest individually. The bootstrap estimations were at the low end of the range for both forests combined and each forest separately. For example, bootstrap estimated that both forests combined may have 174 species. The high end of the range was determined by second order jackknife, which estimated 214 species for both forests (Table 1). The Chao 2 and ICE estimators produced moderate estimates (191 and 192, respectively) and may be more realistic for this data set. These two estimators suggest that approximately 81% of the actual species present on the two forests were sampled over five years. Species accumulation curves and weekly richness were plotted for the combined forests (Fig. 2), the GWNF (Fig. 3), and the MNF (Fig. 4).

The number of adult specimens captured over five years was 8,884 with 155 species identified: 104 from the GWNF and 127 from the MNF (Table 2). These adults represent eight families, with most species Tenthredinidae (121), followed by Pamphiliidae (14), Argidae (7), Pergidae (4), Cephidae (3), Xiphydriidae (3), and Xyelidae (2). Pergids were the most abundant with 4,529 individuals, 4,481 being *Acordulecera dorsalis* Say. Tenthredinid total abundance was 4,240, followed by Xyelidae (33), Argidae (31), Pamphiliidae (28), Xiphydriidae (15), Cephidae (7), and Diprionidae (1). Pergids made up 59% of the abundance in the GWNF, but only 4% of the species richness. In the MNF, pergids made up 38.6% of abundance and accounted for 3% of the richness. However, the tenthredinids collected in the GWNF comprised 76% of the richness and 39.9% of the abundance. MNF tenthredinids accounted for 81% of richness and 59.7% of abundance. The more abundant species following *A. dorsalis* were *Pristiphora banksi* Marlatt, *Pachynematus corniger* (Norton), *Paracharactus rudis* (Norton), *Taxonus*





Figs. 2–3. Species accumulation curves. 2 (Top), Combined George Washington and Monongahela national forests for 15 weeks each year from 1995–1999. 3 (Bottom), George Washington National Forest for 15 weeks each year from 1995–1999.

pallipes (Say), *Aneugmenus flavipes* (Norton), *Taxonus pallidicornis* (Norton), *Nematus radialis* Smith, *Taxonus rufocinctus* (Norton), and *Ametastegia pulchella* (Rohwer). All of these species were taken from both forests, though not in the same order of abundance (Table 3). Although species richness was high, as measured by the 155 species of Symphyta caught in the forests, 87 were represented by five or fewer specimens (Table 4).

Many species were collected from only one of the two forests. Twenty-eight species were found exclusively in the GWNF. Families which contained species unique to GWNF were Argidae (3), Cephidae (1), Diprionidae (1), Pamphiliidae (5), and Tenthredinidae (18). Fifty-one species were

Table 1. Species richness estimates using several diversity estimators for the George Washington National Forest (GWNF), Monongahela National Forest (MNF), and both combined.

Method	Both Forests	GWNF	MNF
Bootstrap	174	117	143
Chao2	191	144	157
ICE	192	139	157
2nd-order jackknife	214	156	177

found only in MNF, and these were in the families Cephidae (1), Pamphiliidae (6), Tenthredinidae (42), and Xiphydriidae (2). Sixty-one species were collected from both forests.

Trends in abundance for certain species were evident over the five years. *Acordulecera dorsalis* has a peak flight time at the end of May. Sampling after that yielded very few specimens. The flight time of *Pristiphora banksi* peaks during the second or third week in June.

Over the five years of sampling, adult Symphyta were collected from Malaise traps from the earliest date (6 May) through the latest (18 August) (Table 4). The ten more abundant species usually flew from early May until late August. While abundance peaked for these species at different times of the season, they were caught with some consistency during the entire three-month sampling period. The first five weeks of each sampling season were critical and accounted for 60% of 1995 adults, 82% of 1996 adults, 32% of 1997 adults, 47% of 1998 adults, and 66% of 1999 adults (Table 5).

Foliage samples produced 11,621 larval individuals from 1995 through 1999. Eight different genera were represented. *Acordulecera* comprised 63.5% of all symphytan larvae with 7,373 specimens, while *Periclista* (several species) comprised 20.0% with 2,328 specimens. Other larvae were Nematinae [probably mostly *P. chlorea* (Norton) and *Craterocercus* spp.] (1,220), *Caliroa* spp. (108), Pamphiliidae (31), *Arge* sp. (14), *Dimorphopteryx* sp. (14), and *Megaxyela* sp. (3).

The general trend for *Acordulecera* larvae was a sharp increase over the first few sampling weeks, peaking in late May, then sharply declining. *Periclista* larvae also declined sharply after their peak in early June.

Discussion

While a high diversity of Symphyta occurred in our samples, there are a few factors that may have influenced sample content. First, sampling by Malaise traps captures only those species that fly at the level of the collecting net. Species that live primarily in forest canopy probably were not in the samples or occurred in small numbers. *Periclista*, for example, comprised 20% of the total larvae captured but only 0.01% of the adults. Second, Malaise traps

Table 2. Adult Symphyta species richness and abundance by family as sampled from 1995 through 1999 in the George Washington National Forest (GWNF) and Monongahela National Forest (MNF).

Family	Species Richness			Abundance		
	GWNF	MNF	Total	GWNF	MNF	Total
Argidae	7	4	7	18	13	31
Cephidae	2	2	3	5	2	7
Diprionidae	1	0	1	1	0	1
Pamphiliidae	8	9	14	12	16	28
Pergidae	4	4	4	3176	1353	4529
Tenthredinidae	79	103	121	2147	2093	4240
Xiphydriidae	1	3	3	8	7	15
Xyelidae	2	2	2	14	19	33
Total	104	127	155	5381	3503	8884

Table 3. The ten more abundant species of adult Symphyta sampled from 1995 through 1999 in the George Washington National Forest (GWNF) and Monongahela National Forest (MNF).

GWNF		MNF	
Species	Abundance (% Total)	Species	Abundance (% Total)
Acordulecera dorsalis Say	3,154 (58.6%)	*Acordulecera dorsalis* Say	1,327 (37.9%)
Pristiphora banksi Marlatt	1,083 (20.1%)	*Pachynematus corniger* (Norton)	419 (12.0%)
Aneugmenus flavipes (Norton)	158 (2.9%)	*Paracharactus rudis* (Norton)	256 (7.3%)
Taxonus pallidicornis (Norton)	100 (1.9%)	*Taxonus pallipes* (Say)	148 (4.2%)
Pristiphora cincta Newman	90.00 (1.7%)	*Pristiphora banksi* Marlatt	141 (4.0%)
Pachynematus corniger (Norton)	68.00 (1.3%)	*Nematus radialis* Smith	102 (2.9%)
Ametastegia pulchella (Rohwer)	53.00 (1.0%)	*Taxonus rufocinctus* (Norton)	97 (2.8%)
Taxonus pallipes (Say)	53 (1.0%)	*Empria multicolor* (Norton)	62 (1.8%)
Macrophya formosa (Klug)	50 (0.9%)	*Aglaostigma quattuordecimpunctatum* (Norton)	61 (1.7%)
Nematus ostryae (Marlatt)	44 (0.8%)	*Pristiphora chlorea* (Norton)	53 (1.5%)

were in use for only 15 weeks starting in early May. While traps were present during most species' peak fight times, some species which were more active either before or after traps were present may have been excluded entirely. The traps were placed in the same location each year, and some species may have avoided the traps. In most cases, the species that appeared in low numbers such as *Sphacophilus cellularis*

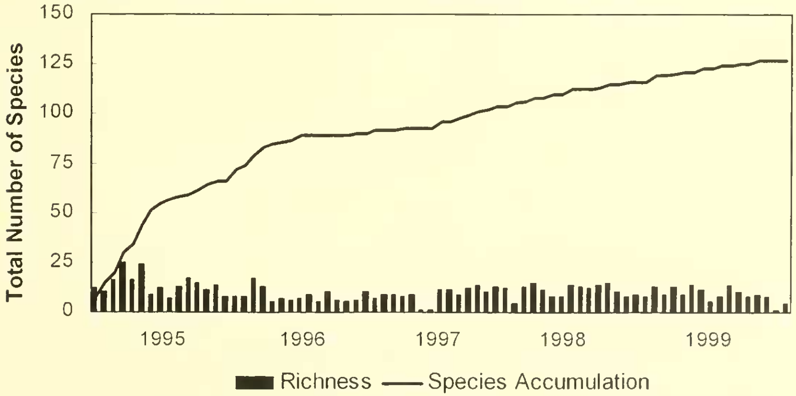


Fig. 4. Species accumulation curve for the Monongahela National Forest for 15 weeks each year from 1995–1999.

Table 4. Symphyta collected by Malaise traps from 1995 through 1999 in the George Washington National Forest (GWNF) and Monongahela National Forest (MNF).

Family, Species	GWNF Flight Range	GWNF Total Count	GWNF Years Trapped	MNF Flight Range	MNF Total Count	MNF Years Trapped
Argidae						
Arge macleayi (Leach)	25 May	1	1998	2 Aug–4 Aug	3	1997, 1999
Arge pectoralis (Leach)	24 Jul	1	1995	3 Aug	1	1998
Arge quidia Smith	20 Jul	2	1998	20 Jul	1	1998
Arge willi Smith	5 May–24 Jul	9	1995–1999	18 May–11 Aug	8	1996–1999
Schizocerella pilicornis (Holmgren)	4 Aug	1	1997			
Sphacophilus celluaris (Say)	10 Jul–26 Jul	3	1995, 1999			
Sterictiphora serotina Smith	15 May	1	1995			
Cephidae						
Janus abbreviatus (Say)				19 Jun	1	1995
Janus bimaculatus (Norton)	20 May–29 May	4	1995, 1996			
Janus integer (Norton)	29 May	1	1995	19 Jun	1	1995
Diprionidae						
Neodiprion sp. (male)	7 Jul	1	1997			
Pamphiliidae						
Acantholyda angulata (MacGillivray)				18 May	1	1998
Acantholyda luteomaculata (Cresson)				21 Jul	1	1997
Acantholyda zappei (Rohwer)	2 Jun	1	1997			
Neurotoma fasciata (Norton)	19 Jul	1	1999			
Onycholyda luteicornis (Norton)	19 May	1	1997	5 Jun	1	1995
Onycholyda quebecensis (Provancher)	8 May	1	1995			
Onycholyda rufofasciatus (Norton)				24 Jun	1	1996
Pamphilius middlekauffi Shinohara & Smith	25 May–8 Jun	2	1998			
Pamphilius ochreipes (Cresson)	10 May	1	1999			
Pamphilius pallimaculus (Norton)	12 Jun–24 Jul	4	1995, 1999	14 Jul–4 Aug	4	1997–1999
Pamphilius persicum MacGillivray				15 Jun–26 Jun	2	1995, 1998
Pamphilius phyllisae Middlekauff				25 May–12 Jul	4	1998, 1999
Pamphilius rileyi (Cresson)	8 May	1	1995	12 Jun	1	1995
Pamphilius semicinctus (Norton)				8 May	1	1995

Table 4. Continued.

Family, Species	GWNF Flight Range	GWNF Total Count	GWNF Years Trapped	MNF Flight Range	MNF Total Count	MNF Years Trapped
Pergidae						
Acordulecera dorsalis Say	5 May–17 Aug	3,154	1995–1999	6 May–12 Aug	1,327	1995–1999
Acordulecera maculata MacGillivray	20 May–12 Jun	2	1995, 1996	26 May–26 Jul	3	1999
Acordulecera mellina MacGillivray	1 Jun–12 Aug	4	1995, 1996, 1998	19 Jul–21 Jul	2	1997, 1999
Acordulecera pellucida (Konow)	5 Jun–7 Aug	16	1995, 1996, 1999	20 May–11 Aug	21	1995–1999
Tenthredinidae						
Aglaostigma quattuordecimpunctatum (Norton)	17 May–31 May	2	1999	11 May–21 Jun	61	1995–1999
Aglaostigma semiluteum (Norton)				19 Jun–29 Jun	4	1995, 1996, 1998
Aglaostigma sp. #1				22 May	1	1995
Ametastegia aperta (Norton)	5 Jul–24 Jul	2	1995, 1999	12 Jun–24 Jul	5	1995, 1999
Ametastegia becra Smith	30 Jun–1 Jul	2	1996, 1997	28 Jul	1	1997
Ametastegia pallipes (Spinola)				18 May–28 Jul	11	1996–1999
Ametastegia pulchella (Rohwer)	5 May–14 Aug	53	1995–1999	24 May–14 Aug	48	1995–1999
Aneugmenus flavipes (Norton)	10 May–17 Aug	158	1995–1999	18 May–4 Aug	8	1996–1999
Caliroa lobata MacGillivray	15 Jul	1	1996			
Caliroa lunata MacGillivray	29 Jun–17 Jul	2	1995, 1998	21 Jul–7 Aug	2	1995, 1997
Caliroa obsoleta (Norton)				10 Jun–16 Aug	3	1996, 1999
Caliroa quercuscoccinea (Dyar)	5 Jun–17 Aug	11	1995–1999	26 Jun–14 Aug	5	1995, 1997, 1999
Caliroa spp. (males)	6 Jul–12 Aug	19	1996–1998, 1995	23 Jun–9 Aug	4	1997, 1999
Caulocampus acericaulis (Macgillivray)				10 May–29 May	4	1995, 1999
Craterocercus fraternalis (Norton)	5 May–12 May	7	1995–1997	6 May–31 May	28	1995–1999
Craterocercus obtusus (Klug)	6 May	1	1996	6 May–18 May	5	1996, 1998
Dimorphopteryx pinguis (Norton)	5 Jun–7 Aug	3	1995, 1996	5 Aug	1	1996
Dimorphopteryx virginicus (Rohwer)				26 Jul	1	1999
Dolerus hebes Goulet	17 May	1	1999			
Dolerus nortoni Ross				5 May–12 May	3	1996, 1997
Empria coryli (Dyar)				5 May–10 May	2	1997, 1999
Empria maculata (Norton)	20 May–13 Jul	9	1996, 1998, 1999	17 May–30 Jun	9	1995–1999
Empria multicolor (Norton)	25 May–12 Jun	6	1995, 1998, 1999	18 May–12 Jul	62	1995–1999
Erythraspides vitis (Harris)	7 Aug	1	1995			
Eupareophora parca (Cresson)				10 May–19 May	7	1996–1999
Eutomostethus ephippium (Panzer)	17 May–5 Jul	2	1999	10 May	1	1999
Fenusa ulmi Sundevall				19 May–27 May	2	1996, 1997

Table 4. Continued.

Family, Species	GWNF			MNF		
	Flight Range	Total Count	Years Trapped	Flight Range	Total Count	Years Trapped
Halidamia affinis (Fallen)				6 May–9 Jun	3	1996, 1997
Hemichroa militaris (Cresson)				27 May–12 Jun	7	1995, 1996, 1999
Hemitaxonus albidopictus (Norton)	25 May	1	1998	20 May–10 Aug	15	1995–1999
Hemitaxonus dubitatus (Norton)				10 May–22 May	2	1995, 1999
Hoplocampa halcyon (Norton)				5 May–13 May	20	1995–1997, 1999
Hoplocampa marlatti Rohwer	12 May	1	1997	5 May–20 May	8	1995–1999
Leucopelmonus annulicornis (Harrington)	11 May–5 Jun	11	1995, 1996, 1998, 1999	11 May–23 Jun	21	1995–1999
Macremphytus tarsatus (Say)	26 Jul	1	1999			
Macremphytus testaceus (Norton)	23 Jun–3 Jul	2	1995, 1997	26 Jul	1	1999
Macrophya cassandra Kirby	11 May–22 Jun	5	1995, 1996, 1998	20 May–17 Jun	1	1995, 1996, 1999
Macrophya flavicoxae (Norton)				7 Jun–22 Jun	7	1998, 1999
Macrophya flavolineata (Norton)				20 May–27 May	2	1996
Macrophya flicta MacGillivray	27 May–27 Jul	6	1995, 1996, 1998			
Macrophya formosa (Klug)	1 Jun–24 Jul	50	1995–1999	10 Jun–7 Jul	1	1995–1999
Macrophya goniphora (Say)	28 Jun	1	1999	12 Jul–9 Aug	17	1999
Macrophya lineata Norton				14 Jun	1	1998
Macrophya macgillivrayi Gibson				3 Jun–14 Jun	1	1996, 1999
Macrophya masoni Gibson	21 Jul–2 Aug	3	1997, 1999			
Macrophya mensa Gibson	18 May–10 Aug	5	1995, 1997–1999			
Macrophya nigra (Norton)	29 Jun–28 Jul	15	1995, 1997–1999	30 Jun–17 Aug	2	1995, 1997–1999
Macrophya pulchella (Klug)	20 May–26 Jul	11	1996, 1998, 1999	19 Jul–20 Jul	6	1998, 1999
Macrophya tibiator Norton	19 May–14 Jun	10	1995–1997, 1999	13 May–26 Jun	2	1995, 1996, 1998
Macrophya trisyllaba (Norton)				29 May–7 Aug	5	1995, 1997, 1999
Macrophya varia (Norton)	12 Jun–11 Aug	24	1995–1999			
Monophadnoides geniculatus (Hartig)	22 May–29 May	4	1995, 1999	24 May	1	1999
Monophadnoides pauper (Provancher)	24 May–31 May	3	1999	31 May	3	1999
Monophadnus aequalis Macgillivray	5 May	2	1997	8 May	1	1995
Monophadnus bakeri Smith				20 May	1	1996
Monophadnus conspiculatus MacGillivray	18 May–29 May	6	1995–1998			
Monophadnus pallescens (Gmelin)				5 May–6 May	1	1996, 1997
Monostegia abdominalis (F.)				28 Jun–28 Jun	5	1999
Nefusa ambigua (Norton)	18 May–12 Jun	16	1995, 1996, 1998, 1999	1 Jun–16 Aug	44	1995–1999

Table 4. Continued.

Family, Species	GWNF			MNF		
	Flight Range	Total Count	Years Trapped	Flight Range	Total Count	Years Trapped
Nematus #1	29 May	1	1995	19 Jun–12 Jul	4	1995, 1999
Nematus #2	6 Jul–12 Aug	27	1995–1999	27 Jul–17 Aug	11	1995–1999
Nematus #3				26 May–27 May	2	1996, 1997
Nematus #4	10 May–24 May	2	1999	5 May–14 Aug	35	1995–1999
Nematus abbotii (Kirby)	12 May–4 Aug	9	1995–1997	13 May–14 Jun	9	1995, 1996, 1998, 1999
Nematus carpini (Marlatt)				22 Jun	1	1998
Nematus coryli Cresson				3 Aug–4 Aug	2	1997, 1998
Nematus latifasciatus Cresson				8 Jun	1	1998
Nematus lipovskyi Smith	8 May–22 May	5	1995	5 May–24 May	6	1996–1999
Nematus near *atriceps* (Marlatt)	25 May–12 Aug	32	1995–1998	16 Jun–28 Jul	6	1997, 1999
Nematus ostryae (Marlatt)	19 May–17 Aug	44	1995–1999	5 Jun–14 Aug	11	1997–1999
Nematus radialis Smith	10 May–2 Jun	12	1995–1999	10 May–16 Jun	102	1995–1999
Nematus tibialis Newman	12 Jun–17 Aug	19	1995–1999	11 May–10 Aug	12	1995–1999
Neopareophora litura (Klug)	6 May–10 May	3	1995, 1996, 1999	5 May–12 May	13	1996, 1997, 1999
Pachynematus #1				29 May–5 Jun	3	1995, 1999
Pachynematus #2	27 May	1	1996			
Pachynematus corniger (Norton)	6 May–11 Aug	68	1995–1999	5 May–17 Aug	419	1995–1999
Pachynematus extensicornis (Norton)	20 Jul	1	1998			
Paracharactus rudis (Norton)	10 May–7 Jun	15	1996, 1998, 1999	6 May–17 Aug	256	1995–1999
Periclista albicollis (Norton)	10 May	3	1999	5 May–19 May	24	1997–1999
Periclista diluta (Cresson)	8 May	1	1995	10 May–2 Jun	7	1996–1999
Periclista inaequidens (Norton)				5 May–22 May	6	1995, 1997, 1998
Periclista marginicollis (Norton)	6 May–19 May	4	1995–1997, 1999	5 May–9 Jun	18	1995, 1997–1999
Periclista media (Norton)	8 May–12 May	6	1995, 1997, 1999	5 May–2 Jun	20	1995–1999
Periclista stannardi Smith				11 May–1 Jun	2	1998
Phymatocera fumipennis (Norton)				14 Jun	2	1999
Priophorus pallipes (Lepeletier)	29 May	1	1995	22 May–26 Jul	5	1995, 1999
Pristiphora banksi Marlatt	5 May–17 Aug	1,083	1995–1999	11 May–16 Aug	141	1995–1999
Pristiphora bivittata (Norton)	17 May	1	1999			
Pristiphora chlorea (Norton)	5 May–25 May	28	1995–1999	6 May–16 Jun	53	1996–1999
Pristiphora cincta Newman	8 May–7 Aug	90	1995–1999	20 May–17 Jul	2	1995, 1996
Pristiphora mollis (Hartig)				10 May	1	1999
Pristiphora rufipes Lepeletier				17 May–3 Aug	8	1997–1999
Pristiphora sp. #1				10 May	2	1999

Table 4. Continued.

	GWNF			MNF		
Family, Species	Flight Range	Total Count	Years Trapped	Flight Range	Total Count	Years Trapped
Pristiphora zella Rohwer	24 Jul	1	1995			
Profenusa alumna (MacGillivray)	17 Jun–16 Aug	2	1999	17 Jun–11 Aug	6	1996–1998
Pseudodineura parva (Norton)				25 May–1 Jun	5	1995, 1998
Strongylogaster impressata Provancher				27 May	1	1996
Strongylogaster multicincta Norton	10 May–22 May	2	1995, 1999			
Strongylogaster polita Cresson	12 Jun	1	1995			
Strongylogaster soriculatipes Cresson	10 May–20 May	3	1996, 1997, 1999			
Strongylogaster tacita (Norton)				25 May	1	1998
Taxonus borealis MacGillivray	15 Jun–28 Jun	3	1997–1999	1 Jun–12 Aug	52	1995–1999
Taxonus epicera (Say)	24 May–2 Jun	4	1996, 1997, 1999	25 May–16 Jun	7	1995–1999
Taxonus pallicoxus (Provancher)	27 May–31 Jul	18	1995, 1996	24 May–10 Aug	32	1995, 1998, 1999
Taxonus pallidicornis (Norton)	22 May–16 Aug	103	1995–1999	8 Jun–12 Aug	23	1995–1999
Taxonus pallipes (Say)	18 May–17 Aug	53	1995–1999	27 May–16 Aug	148	1995–1999
Taxonus proximus (Provancher)	21 Jul–14 Aug	3	1995, 1997	12 Jun–16 Aug	30	1995–1999
Taxonus rufocinctus (Norton)	29 May–10 Aug	14	1995–1999	24 May–16 Aug	97	1995–1999
Taxonus spiculatus (MacGillivray)	26 Jun–21 Jul	3	1995, 1997	19 Jun–31 Jul	4	1995, 1997
Taxonus terminalis (Say)	20 May–2 Aug	19	1995–1999	26 May–16 Aug	16	1995–1999
Tenthredo appalachia Goulet & Smith				10 Jun–10 Jul	2	1995, 1996
Tenthredo fernowi Goulet & Smith	12 Jun	1	1995			
Tenthredo grandis (Norton)				23 Jun	1	1997
Tenthredo lobata (Norton)	17 Aug	1	1998			
Tenthredo masneri Goulet & Smith				16 Jun–3 Aug	9	1995–1999
Tenthredo mellicoxa Provancher				23 Jun	1	1997
Tenthredo rufopecta (Norton)	14 Jun–10 Jul	2	1995, 1999	7 Jul–26 Jul	5	1997, 1999
Tenthredo sp. #1				3 Jun	1	1996
Tenthredo verticalis Say				24 Jun–31 Jul	2	1995, 1996
Tenthredo yuasi MacGillivray				14 Jun–15 Jun	3	1998, 1999
Xiphydriidae						
Xiphydria abdominalis Say				26 Jun–17 Jul	2	1995
Xiphydria maculata Say				8 Jun	1	1998
Xiphydria tibialis Say	22 Jun–7 Aug	8	1995–1999	12 Jun–30 Jun	4	1995, 1997, 1999
Xyelidae						
Xyela alpigena (Strobl.)	8 May–2 Jun	11	1995, 1997, 1999	8 May–16 Jun	11	1995, 1997
Xyela sp. (males)	8 May–26 May	3	1995, 1997	15 May–16 Jun	8	1995, 1997

(Say), *Sterictiphora serotina* Smith, and *Janus abbreviatus* (Say), have hosts such as morning glory, *Ipomoea purpurea* (L.) Roth, black cherry, *Prunus serotina* Ehrh., and *Salix* and white poplar, *Populus alba* L., respectively, which are uncommon in both forests. Alternatively, species such as *Acordulecera dorsalis*, whose hosts dominate the forest (*Quercus* spp. and *Carya* spp.), were found in greater abundance. However, some Symphyta did not fit this pattern. The host plant for *Pristiphora banksi*, *Vaccinium*, was not found in great abundance in the MNF and yet it was the second most abundant species of Symphyta.

A high diversity of symphytan larvae was collected even though only five host plant groups were sampled. These larvae as a group show considerable variability in their host plants and can feed on foliage of larger trees or small groundcover flora such as grasses, blueberries, ferns, and other plants. Another factor which limited our larval diversity is that only foliage from the middle to lower canopy was sampled. Symphytan larvae on other food plants in the forest or feeding on upper canopy foliage were not sampled using this method. The adult abundance and richness were affected by seasonal sampling time; the same is true of the larvae. Assessing population fluctuations and abundances is limited since our sampling period was only 15 weeks from early May through mid-August. Some symphytan larvae are present before, or after this period, or both. Seasonal population changes over the five-year period could be responsible for overestimated and underestimated abundances when comparing samples to predict species diversity. Larval feeding habits may have been a factor. For instance, *Acordulecera* larvae were especially problematic because they were in the only genus sampled that existed in large gregarious clusters. A single sample can contain hundreds of larvae.

As with other species rich taxa, Symphyta diversity plays an important role in the forests. They are likely also important in forest food webs as herbivores preyed upon by numerous species of invertebrates and vertebrates. The eruciform larvae of Symphyta are similar to lepidopteran larvae which are recognized as having both high fat (Redford and Dorea 1984) and very low chitin content relative to other insects, thus making them especially valuable in the diets of songbirds (Sample et al. 1993). Some ornithologists collectively refer to larval sawflies and lepidopterans as caterpillars when recording dietary habits of songbirds (Rodenhouse and Holmes 1992). As abundance of spring defoliating lepidopterans may be reduced during *Btk* applications for gypsy moth suppression (Marshall et al. 2002), sawfly larvae may survive to be preyed upon by songbirds. Understanding the diversity, abundance, and seasonality of adult and larval Symphyta in a hardwood forest ecosystem may help make predictions about how certain chemical or biological controls effect Symphyta and the forest food web.

Table 5. Weekly number of adult Symphyta collected by Malaise traps from 1995 through 1999 in both the George Washington National Forest and Monongahela National Forest.

Week	Year 1995	1996	1997	1998	1999
1	201	506	191	83	277
2	220	353	90	254	248
3	292	384	85	239	241
4	279	231	95	140	294
5	105	51	51	65	145
6	141	60	38	61	185
7	77	37	65	80	34
8	68	31	137	102	58
9	37	29	92	53	67
10	55	31	64	81	75
11	132	27	87	179	48
12	124	26	153	99	64
13	110	25	175	98	53
14	70	30	161	85	32
15	25	47	110	31	15

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